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XXV.—*Contributions to our Knowledge of the Spongida,—*  
*Order I. Carnosa.* By H. J. CARTER, F.R.S. &c.

IN the first part of this contribution I propose to enumerate with short commentary all the species of the order Carnosa that have been made known, tabulating them afterwards as they might be arranged with reference to my Classification (No. 23\*); and in the second part I propose giving a descrip-

\* Publications to which reference is made in the following communication:—

- 1.—1838. DUJARDIN, F. “Observations sur les Éponges et en particulier sur la Spongille ou Éponge d’eau douce,” *Ann. d. Sc. Nat. Zool.* sér. 2, tome x.
- 2.—1842. JOHNSTON, G. A History of British Sponges and Lithophytes.
- 3.—1847. NARDO, D. “Osservazioni anatomiche sopra l’animale marino detto volgarmente Rognone di mare,” *Atti dell’ Istituto Veneto*, vol. vi.
- 4.—1862. SCHMIDT, O. Die Spongien des adriatischen Meeres.
- 5.—1864. SCHMIDT, O. Die Spongien &c. Erstes Supplement.
- 6.—1866. BOWERBANK, J. S. A Monograph of the British Spongiadæ, vols. i. and ii.
- 7.—1866. SCHMIDT, O. Die Spongien des adriatischen Meeres. Zweites Supplement.
- 8.—1867. SELENKA, E. “Ueber einige neue Schwämme aus der Südsee,” *Zeitschrift f. wiss. Zoologie*, Bd. xvii.

tion of the elastic tissue of the Spongida, which, although principally developed in the Carnosa, is so widely distributed throughout the class, that it may be considered one of the constituent elements of the Spongida, and therefore deserving of that special attention which hitherto it has not had. Finally, I propose adding some observations on other sponges which seem to claim admission into the Carnosa, ending with a notice of Dr. Oscar Schmidt's genus *Cellulophana*.

Since the Ray Society published the late Dr. Bowerbank's work on the British sponges, entitled 'A Monograph of the British Spongiadae' (Nos. 6 and 21 respectively), which is chiefly confined to the species growing on the shores and comparatively shallow depths of the submarine bank immediately round the British Isles, not only more species from this locality have been discovered, but the "dredgings" of H.M.S. 'Porcupine,' having extended a little beyond the border of the bank into the "deep sea" of the Atlantic

- 9.—1868. SCHMIDT, O. Die Spongien der Küste von Algier. Mit Nachträgen zu den Spongien des adriatischen Meeres. (Drittes Supplement.)
- 10.—1869. CARTER, H. J. "A Descriptive Account of Four Sub-spherical Sponges, Arabian and British, with General Observations," Ann. & Mag. Nat. Hist. ser. 4, vol. iv.
- 11.—1869. CARTER, H. J. "On *Grayella cyathophora*, a new Genus and Species of Sponges," *ibid.* vol. iv.
- 12.—1870. CARTER, H. J. "Note on the Sponges *Grayella*, *Osculina*, and *Cliona*," *ibid.* vol. v.
- 13.—1870. SCHMIDT, O. Grundzüge einer Spongienfauna des atlantischen Gebietes.
- 14.—1871. CARTER, H. J. "A Descriptive Account of three Pachytragous Sponges growing on the Rocks of the South Coast of Devon," Ann. & Mag. Nat. Hist. ser. 4, vol. vii.
- 15.—1872. HÄCKEL, E. Die Kalkschwämme, ein Monographie in zwei Bänden Text und Atlas, mit 60 Tafeln Abbildungen.
- 16.—1872. GIARD, A. "Recherches sur les Ascidies Composées ou Synascidies," Archives de Zoologie expérimentale et générale, H. de Lacaze-Duthiers, tome i.
- 17.—1873. CARTER, H. J. "On two new Species of Gummineæ, &c.," Ann. & Mag. Nat. Hist. ser. 4, vol. xii.
- 18.—1873. GIARD, A. "Contribution à l'Histoire Naturelle des Synascidies," Archives de Zoologie expérimentale et générale, H. de Lacaze-Duthiers, tome ii.
- 19.—1874. CARTER, H. J. "On the Spongozoa of *Halisarca Dujardini*," Ann. & Mag. Nat. Hist. ser. 4, vol. xiii.
- 20.—1874. CARTER, H. J. "On *Halisarca lobularis*," *ibid.*
- 21.—1874. BOWERBANK, J. S. A Monograph of the British Spongiadae, vol. iii.
- 22.—1874. CARTER, H. J. "Descriptions and Figures of Deep-sea Sponges and their Spicules from the Atlantic Ocean, dredged up on board H.M.S. 'Porcupine,' with Figures and Descriptions of

Ocean, have brought to light a still greater number (Nos. 17, 22, and 25, pp. 17, 207, and 226 respectively), most of which must be considered as much British as those which, growing a little further in towards the shore, are more accessible. Hence all these will also have to be added to the "British Sponges."

Among them are a few belonging to my order Carnosa, of which nothing is stated in the 'British Spongiadae,' except *Hymeniacion Dujardini*, Bk. (No. 6, vol. ii. p. 224), which the author has endeavoured to identify with *Halisarca Dujardini*, Johnston (No. 2, pp. 192 and 251), in a way that almost amounts to "burlesque," inasmuch as his statement is made upon the assumption that Dujardin (who first described *Halisarca*, No. 1, p. 6, and No. 2, *l. c.*) and Johnston (who designated it *Halisarca Dujardini*, and made a genus of it under the following characters:—"Spongia gelatinosa diffuse repens cute tenui et laevi vestita spiculis et cellulis fibratis carens. Genus litorosum, rupes et fucorum radices ornans." No. 2, p. 251) had made a mistake!

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- some remarkable Spicules from the Agulhas Shoal and Colon, Panama, respectively," Ann. & Mag. Nat. Hist. ser. 4, vol. xiv.
- 23.—1875. CARTER, H. J. "Notes Introductory to the Study and Classification of the Spongida," *ibid.* vol. xvi.
- 24.—1876. BARROIS, CH. Thèse pour le Grade de Docteur ès Sciences Naturelles. (Also printed in Ann. d. Sc. Naturelles, Zool. sér. 6, tome iii.)
- 25.—1876. CARTER, H. J. "Descriptions and Figures of Deep-sea Sponges," Ann. & Mag. Nat. Hist. ser. 4, vol. xviii.
- 26.—1877. SCHULZE, F. E. "Untersuchungen über den Bau und die Entwicklung der Spongien. Die Gattung *Halisarca*," Zeitschrift f. wiss. Zoologie, Bd. xxviii.
- 27.—1879. SCHULZE, F. E. "Untersuchungen über den Bau und die Entwicklung der Spongien. Die Familie der Chondrosida," *ibid.* Bd. xxix.
- 28.—1879. CARTER, H. J. "Contributions to our Knowledge of the Spongida," Ann. & Mag. Nat. Hist. ser. 5, vol. iii.
- 29.—1879. CARTER, H. J. "On a new Species of Excavating Sponge (*Alectona Millari*), &c.," Journ. Roy. Microscop. Soc. vol. ii.
- 30.—1880. CARTER, H. J. "Report on Specimens dredged up from the Gulf of Manaar, and presented to the Liverpool Free Museum by Captain W. H. Cawne Warren," Ann. & Mag. Nat. Hist. ser. 5, vol. vi.
- 31.—1880. SCHMIDT, O. Spongien des Meerbusen von Mexico (und des Caribischen Meeres). Zweites (Schluss-) Heft.
- 32.—1881. CARTER, H. J. "Supplementary Report on Specimens dredged up from the Gulf of Manaar, together with others from the Sea in the Vicinity of the Basse Rocks and from Bass's Straits respectively, presented to the Liverpool Free Museum by Capt. W. H. Cawne Warren," Ann. & Mag. Nat. Hist. ser. 5, vol. vii.
- 33.—1881. SCHÜLZE, F. E. "Untersuchungen über den Bau und die Entwicklung der Spongien. Zehnte Mittheilung. *Corticium candelabrum*, O. Schmidt," Zeitschrift f. wiss. Zoologie, Bd. xxxv. S. 410.

The fact is that *Hymeniacion Dujardinii*, Bk., although well described (No. 6, *l. c.*) and illustrated (No. 21, pl. xxxviii. figs. 1-4), is no *Hymeniacion* at all, but a *Hymedesmia* according to Dr. Bowerbank's classificatory diagnoses (No. 6, vol. i. p. 153 &c.); for the thin gelatinous film of which it is composed supports a bed of spicules ("tibiella" with inflated ends, not simply cylindrical and obtuse, as figured by Dr. Bowerbank, No. 21, *l. c.*) confusedly arranged; from the surface of which project shorter, clavate, spined spicules with an inflated end respectively, in an echinating manner (that is, with their points outwards), while the whole *when dry* is brittle and not tenacious like the gummy consistence of the Carnosa. Thus the character of *Hymeniacion Dujardinii* more resembles that of the lamina of "*Microciona* and *Hymenrhopia*" (No. 6, vol. i. p. 190), to which Dr. Bowerbank himself has especially likened *Hymedesmia*, than the massive forms with crumb-of-bread-like structure in *Hymeniacion*. Similar remarks might be made on his *Hymeniacion paupertas*, whose description just precedes that of *H. Dujardinii*; but this is not the place for them. It is therefore Dr. Bowerbank's and not Dujardin's "misapprehension" of the "structure of the genus *Halisarca*" (No. 6, vol. ii. p. 225) that alone concerns us for the present as it has done. Let us now turn our attention to the enumeration and classification of the Carnosa as proposed in my "Notes" (No. 23, p. 43).

## Class SPONGIDA.

### Order I. CARNOSA.

*Char.* Without evident skeleton\*.

#### Family 1. *Halisarcida*.

*Char.* Possessing no spicules.

In 1838 Dujardin discovered on the coast of Normandy (Calvados, No. 1, *l. c.*), and described, the sponge-substance to which he gave the name of "*Halisarca*;" and in 1842 Johnston described the same kind of sponge as a British species from Berwick Bay &c. under the designation of *Halisarca Dujardinii* (No. 2, *l. c.*). To this Schmidt, in 1862, added another species, viz. *Halisarca lobularis* (No. 4, p. 80), which, in 1874, I first found, together with *H. Dujardinii*, growing plentifully on this coast, viz. Budleigh-

\* Emended *postea*, p. 255.

Salterton, South Devon, where I reside (Nos. 19 and 20, pp. 315 and 433 respectively).

As regards *H. Dujardinii*, nothing can be better than Johnston's description and generic diagnosis, excepting that he did not see any ova. They are abundantly present, however (though not far advanced), in the specimens which I have just now (28th June) taken off the rocks, while the more minute histology of the species was described in 1874 (*loc. cit.*).

When fresh and *in situ* the yellow transparent colour and oily appearance of *Hymeniacidon Dujardinii* and *Halisarca Dujardinii* are so much alike that it is almost impossible to distinguish them from one another without microscopic examination, when the presence of the spicules in the former, without any thing else, is quite sufficient. It is therefore not extraordinary that Dr. Bowerbank so far, should *himself* have made the mistake to which I have alluded.

*Halisarca Dujardinii* not only differs from *H. lobularis* when observed *in situ* by shape and colour, the former presenting an even surface with a yellowish transparent colour like oil or albumen ("white of egg" uncooked), and the latter a lobulated surface with a bluish carmine colour, especially over the more prominent parts, but, when examined under the microscope, *H. Dujardinii* is found to consist of a massive structure permeated by an excretory canal-system that has generally only one (but may have more) short tubular vents projecting from the surface, which is otherwise *entirely* covered by a smooth epidermis or dermal layer of sarcode (*cuticula*). On the other hand, *H. lobularis* is made up of contorted anastomosing knotted tubulation, with intervals (*lacunæ*) between the convolutions like those of *Grantia clathrus*, Sdt., = *Clathrina*, Gray, = *Ascetta clathrus*, Hæckel (No. 15, vol. ii. p. 30, Taf. 4), opening here and there, by the union of two or more convolutions, in common vents (No. 26, Taf. 1. figs. 6 and 7); so that there is an excretory canal-system, as usual, together with the spongozoa in groups (ampullaceous sacs), and other sponge-elements *inside* the tubulation, and an external one, apparently produced by cilia, on the *outside*, which may thus keep up a circulation of water throughout its lacunose or reticulated mass. The latter has been called by Hæckel the "intercanal system" (No. 15, vol. i. p. 275); but I have not been able to observe, under the most favourable circumstances, any cilia on the surface of the tubulation in *Clathrina* (which is abundant here); while, from the dermal layer of cells in preserved-in-spirit specimens of *H. Dujardinii* being so like that of *H. lobularis*, I think the former, if examined in the

living state, might also be found to be so ciliated. Lastly, in *H. Dujardini* under the microscope, it may be observed that the spongozoa &c. are but scantily accompanied by filaments of elastic tissue, like that so abundant in the next genus, viz. *Chondrosia*; while in *H. lobularis* there seems to be none at all; so that in this respect *H. lobularis* would appear to be the most simply formed of the two, yielding, from the absence of the elastic element, *permanently* not only to the pressure of objects with which it may come into contact in the "preserving-jar," but, although much thicker than *H. Dujardini* when freshly laid upon the glass slide, also on this account subsiding on being *dried* into a much thinner stratum. When a fragment of *H. Dujardini* is placed on a glass slide in water for examination, it slips away to the border of the cover, from its slimy elastic nature, while that of *H. lobularis* under the same circumstances remains stationary like a bit of soft dough. Hence I cannot understand how specimens of the latter found by Dr. Ch. Barrois on the north coast of France, nearly opposite this place, should be termed "semi-cartilagineuse" (No. 24, p. 42).

Could the calcareous sponges have originated in *H. lobularis*, which, together with the spicules, would be very like *Ascetta* (*Clathrina*), from the tubular, tortuous, anastomosing structure in both being almost identical? At all events, it is remarkable that the earliest forms, according to Hückel, of the calcisponges, viz. *Ascetta*, should afford the only analogous structure among the Spongida, so far as I know, to *Halisarca lobularis* (No. 15, vol. ii. and Atlas).

Thus, when carefully examined, there are such strong differences between *Halisarca Dujardini* and *H. lobularis*, that it almost becomes questionable whether they should be in the same genus.

*Halisarca guttula*, Sdt. (no. 5, p. 41, and Taf. v. fig. 2, No. 9), is thought by Schulze to be the same as his (Schulze's) *H. lobularis purpurea* (No. 26, Taf. i. fig. 5).

Giard's *Halisarca mimosa* (mimic) from Boulogne, which, according to his description, consists of a thin lamina with plane surface, of a brick-red colour varied with orange-yellow, having its oscules bordered with deeper red slightly carmine, from which radiate orange-coloured lines, like "ascidian animalcules" (no. 18, p. 488), requires confirmation. And the other species, which was found at Roscoff, although so like *H. lobularis* that Schulze conjectured it to be the same as his variety, viz. *H. lobularis purpurea* (No. 26, p. 45, Separat-Abdruck), differs from *H. lobularis* in being "semi-cartilagineuse" in consistence, and the specimens possess "une grande

élasticité et repoussent vivement le verre qui les comprime quand on veut en examiner une parcelle au microscope," as my above description of *H. lobularis* will show.

*Halisarca cruenta*, n. sp., 1876.

Smooth, more or less puckered, extending among the detritus of sea-bottom, and agglomerating the whole on its way, so as to give it a dark crimson-red colour, most intense where it is most exposed. Consistence firm, tolerably resilient. Surface, here and there where uninterrupted by the irregularities of the detrital bodies, of glassy smoothness, puckered towards the projecting points of the latter, and presenting vents irregularly scattered on a level with the dermal layer or cuticula. Internal structure more or less permeated by the branches of the excretory canal-system; tolerably resilient; crimson colour of the surface, which is seated in an extremely thin cuticula, fading off into grey internally; tissue, when examined under the microscope, presenting elongated granular cells, rather than the fusiform transparent filaments so characteristic of the Chondrosidæ and upon which the amount of resistance or elasticity in the latter seems to depend, scattered among the spongozoa and other cells &c. of which the body-mass is composed. Ova not seen. Size indefinite, according to the extent of the spreading agglomeration, many portions of which are free from foreign objects to the extent of a quarter of an inch square and deep, which, when cut out, do best for examination.

*Hab.* Marine. Spreading among the detrital objects of sea-bottom and enveloping every particle in its course.

*Loc.* Gulf of Suez.

*Obs.* This forms part of the contents of a small jar of organisms of a like nature, among which is *Chondrilla nucula* growing over a piece of stony coral, collected by J. K. Lord, Esq., in the Gulf of Suez, and presented to the British Museum. It seems to be the same species as that previously noticed by myself under the above name, in my account of the sponges dredged on board H.M.S. 'Porcupine,' in the deep sea of the Atlantic Ocean, near Cape St. Vincent (No. 25, p. 228), of which the supply was too small for any thing but a provisional description; hence the above emended one. In appearance and firmness it is more like *Chondrosia* than *Halisarca Dujardinii* or *H. lobularis*; but in composition, from the comparative absence of the elastic filamentous element and consequent diminution of tenacity, more like the latter.

For an account of the specimens from Bass's Straits provisionally named *Halisarca bassangustiarum*, I must refer the reader to my second Manaar report (No. 32, p. 373), and for that of *H. rubitingens*, also provisionally named (*ib.* p. 366). The latter will be more particularly considered hereafter in connection with *Cellulophana*, Sdt. (No. 4, p. 41, &c.).

*Chondrosia reniformis*, Sdt. This name is taken from Nardo's description (No. 3), translated *in extenso* by Schmidt (No. 4, pp. 40, 41); so that it has been known for many years and, curious enough, to the Adriatic fishermen, under the name of "Carume di mar," which, in Greek, becomes "Halisarca," the name that, just ten years previously, had been given by Dujardin to *Halisarca Dujardinii*, which, as before stated, was found on the coast of Normandy. Since this sponge has been studied by Dr. F. E. Schulze, of Gratz, as well as the preceding genus *Halisarca*, in two separate communications, and the result of his careful investigations thus recorded (Nos. 26 and 27), I cannot do better than refer the reader to these as being a *sine quâ non* to a right understanding of both *Chondrosia* and *Halisarca*, merely adding here that, as the filaments of which the elastic felt-like trama of *Chondrosia reniformis* is characteristically composed form an element in many of the Spongida quite apart from the dendriform skeletal fibre, they demand a distinct consideration, which, not having been accorded to them before, I propose, as before stated, to give hereafter.

*Gummina gliricauda* and *G. ecaudata* are two other species described and figured by Schmidt (No. 4, Taf. iii. figs. 20 and 21 respectively). They appear only to differ in form from *Chondrosia reniformis*; and all, judging of specimens from Madeira which I possess, seem to take in foreign bodies during their growth, although Schmidt does not mention them in *G. gliricauda* and *G. ecaudata* from the Adriatic; but they produce no spicules of their own. It might be questionable how far the "foreign bodies" are a substitute for proper spicules, and thus analogous to the foreign bodies taken in by the Psammonemata for the core of their fibre.

*Chondrosia plebeja*, Sdt., from Algiers (No. 9, p. 1), appears to do the same (that is, to take in foreign bodies); but *Chondrosia tuberculata*, Sdt., from the Adriatic (*ib.* p. 24, Taf. v. fig. 4), contains neither foreign bodies nor spicules, and according to Schmidt is, in the section, very much like *Halisarca lobularis*; wherefore Schulze thinks it to be the same (No. 27,



p. 31, Separat-Abdruck); but if so, why should Schmidt call it "*Chondrosia*," likening its "firmness" especially to *Chondrilla*? If it be *Halisarca lobularis*, then the "semi-cartilagineuse" consistence of the specimen found by Dr. Ch. Barrois at Saint-Vaast, near Cherbourg, can be understood (*loc. cit.*).

## Family 2. Gumminida.

*Char.* Possessing spicules.

*Chondrilla nucula*, Sdt. In 1862 Schmidt established this genus (No. 4, p. 38, Taf. iii. figs. 22, 22a), together with *C. embolopora*, both possessing spicules and both found in the Adriatic Sea. The former appears to be a "world-wide" species; for during the last five years I have had specimens of it from the Red Sea, the Gulf of Manaar, the Mauritius, Molucca Islands, and the West Indies. Schulze has added *Chondrilla mixta*, from the Red Sea, and *C. distincta*, from Ponapé (No. 27, p. 32, Sep.-Abd.).

In 1870 Schmidt described an incrusting species, about "1-2 millim." thick, charged with a pin-like skeleton-spicule and a spinispirular flesh-spicule from the Antilles, to which he gave the name of *Chondrilla phyllodes* (No. 13, p. 26, Taf. vi. fig. 1); and in 1873, I added *Chondrilla australiensis* from Port Jackson (No. 17, p. 23, pl. i. figs. 10-16).

If the species *Lacinia stellifica* from Bass's Straits (No. 8, p. 568, Taf. xxxv. fig. 8), described and illustrated by Selenka in 1867, possesses, as stated, a spicule "ganz ähnlich," exactly like his fig. 13, then it seems to me that he has made a mistake in calling it *calcareous* (Kalksternchen); or the organism is a *Leptoclinum*, M.-Edw., = Tribus 11. Didemniæ, Giard, "Tunique commune remplie de spicules calcaires" (No. 16, p. 644, pl. xxii.). Were the spicule siliceous, then the species would be like Schmidt's *Chondrilla nucula*; but if calcareous, then, as I only know of the existence of similar stellates in the compound Ascidiæ and never in the Calcispongiæ, I think that Selenka's discovery also requires confirmation. If substantiated it would indeed far exceed M. Giard's *Halisarca mimosa* in point of *mimicry*!

*Corticium candelabrum*. Of this sponge Schmidt, who found it in the Adriatic Sea in 1862, made a new genus, observing in his characters, "Spongia incertæ hucusque familiæ," describing and figuring its spicules (No. 4, p. 42, Taf. iii. fig. 25, a-g). There is no doubt, however, of its

family now; for it evidently belongs to our order Carnosa, and, possessing spicules, to our family Gumminida; but very little of the filamentous element, as may be learnt from Schmidt's and Kölliker's observations, appears to exist in it; indeed, Schulze could not see any at all (No. 33, p. 422). It is present, however, in *Corticium abyssi*, but here very scanty, especially in the body-substance; hence the want of tenacity displayed in tearing a portion of the latter to pieces with needles, compared with *Chondrosia* and *Chondrilla*, in both of which this elastic filamentous trama abounds.

In 1868, Schmidt added another species from the Adriatic Sea (No. 9, p. 25, Taf. iii. fig. 6), which he named *C. stelligerum*; and in the same publication (p. 2, Taf. iii. fig. 11), another from the coast of Africa, which he named *Corticium plicatum*, in which the spicules are allied, in their tetractinellid form, to those of *Corticium abyssi*. The latter I described and figured from a specimen found in the "deep sea" at the entrance of the English Channel (No. 17, p. 18, pl. i. figs. 1-9). I have just stated that the filamentous element is very scanty in *Corticium abyssi*, which probably accounts for its amount of tenacity being far less than that of *Chondrosia* and *Chondrilla*, approaching therefore nearer to that of *Halisarca lobularis*. But it is not identical (identisch) with *Samus anonyma*, Gray, as supposed by Schmidt (No. 31, p. 69), which may be seen by my descriptions and figures of these sponges respectively (No. 28, p. 350, pl. xxix. figs. 1-4, and No. 30, p. 59).

My species (named *pro temp.*) *Corticium Kittonii* is only conjectural, being provisionally inferred from the tetractinellid form of some spicules hitherto only found among the detritus of sea-bottom at Colon, Panama (No. 22, p. 24, pl. xv. figs. 48, a-e); while *C. parasiticum* from the "deep-sea" was not sufficient in quantity for much more (No. 25, p. 229, pl. xvi. fig. 52).

*Corticium versatile*, from St. Vincent (West Indies), is another species lately (1880) adverted to by Schmidt, who has unfortunately devoted much more to the possible "combinations" of its tetractinellid form of spicules than to a description of the sponge itself (No. 31, p. 69, Taf. ix. fig. 5). All that is stated of it is that it is a "Crustenschwamm," to which are added figures of the spicule in the plate (*l. c.*), but nothing else. From the form of the flesh-spicule not having been given, if, indeed, there was any, I cannot speak with certainty; but the skeleton-spicules are very like those of *Samus simplex* (No. 30, p. 60, pl. v. figs. 26 a-c), which, of course,

are liable, like those of *C. versatile* and all other tetractinellids, to irregularity in the division of the arms; but when accompanied by a particular form of flesh-spicule in great abundance, as in *Samus anonymus* and *Samus* (olim *Pachastrella*) *parasiticus* (No. 25, p. 410, pl. xv. fig. 41, *a*, *b*, and No. 30, p. 60), I think that, however great the variety in the skeleton-spicule may be, the form of the flesh-spicule *here* should decide the species question, as the branches in the skeleton-spicule are as inconstant as they are accidental. Schmidt's second part of his descriptions of the sponges from the Gulf of Mexico, which were sent to him from America for this purpose (No. 31), reached me on the 2nd July 1880, just two months after my Report on the Manaar specimens (No. 30) had been written and illustrated; or I should have referred therein to his observations in connection with *Corticium versatile* and its relationship with *Pachastrella*, to which now I can only commend the student for instruction.

*Sarcomella medusa*, as its substance proclaims, is an Algerine specimen, shortly described by Schmidt as an irregularly convex body, medusa-like in consistence, and charged with one form of spicule only, viz. acerate, like a *Reniera* (No. 9, p. 1).

*Osculina polystomella*, Sdt. Of this sponge, which came from La Calle, on the Algerine coast, and was forwarded in spirit to Schmidt by Lacaze-Duthiers, the former states in his description of it (No. 9, p. 3, Taf. 1) that its consistence is the same as that of *Chondrilla*, which, together with its being spiculiferous, is sufficient for our classification. It would have been more satisfactory if the thickness of the cortex had been mentioned in the text instead of having only been represented in the illustration with the indefinite term a little (*geringe*), when it may fairly be inferred to be *very much*, magnified. In 1870 I compared *Osculina polystomella* with *Grayella cyathophora* (No. 12, p. 73) from the Gulf of Suez, which in many particulars are very much alike—so much so indeed that I feel compelled now to add *Grayella* provisionally to the Gumminida as follows:—

*Grayella cyathophora* was described and illustrated by myself in 1869; and I still possess the little specimen in spirit as it came to me from the late Dr. J. E. Gray (No. 11, p. 189, pl. vii.). Since then a much larger but dry specimen has been added by purchase to the British Museum, which was stated by the dealer to have come from Port Elizabeth, Cape of Good Hope. It is 4×4 inches superficially, and half an

inch thick, bearing the register no. 71. 6. 5. 1 and my running no. 15. On reexamining the wet specimen, to which I have alluded, I find that the dermal layer or cortex is only 1-277th inch in vertical diameter, but sufficiently thick to present a slippery, homogeneous, glutinous consistence, which, by its opacity, prevents the subjacent structure from being seen; so that, with its stelliferous character, *Grayella cyathophora* also comes within our specification of the Gumminida; but whether all such sponges should be here introduced which conform to this "specification" alone, is questionable; hence I shall return to this point hereafter under the head of "Observations."

*Columnitis squamata*, from the Antilles, is another sponge which Schmidt has added to his Gumminicæ (No. 13, p. 25, Taf. v. figs. 3, 4), and therefore is inserted here; but as a similar incrustation occurs on this coast which I have always regarded as closely allied to, if not the same as, *Donatia* (*Tethya*) *lyncurium*, and *Donatia* itself may justly claim a place among the Carnosa from its semicartilaginous consistence &c., I shall also return to this subject again.

Finally, in 1879 I figured and described a sponge under the name of *Latrunculia corticata*, said to have come from the Red Sea (No. 28, p. 298, pl. xxvii. figs. 1-4), covered with a homogeneous, semicartilaginous, thin dermis surrounding a reticulated structure internally charged with acerate skeleton- and spinispirular flesh-spicules, but the latter varying in form from a "spinispirula" to "sceptrella." When softened by soaking in water the dermal layer is found, under the microscope, to be almost entirely composed of the filamentous feltiform tissue, while the interior is also very tenacious and glue-like; so that, with its spicules, this species also must be classed with our Gumminida.

Hence, when tabulated, the whole will stand thus:—

#### Order 1. CARNOSA.

*Char.* Without evident skeleton.

#### Family 1. Halisarcida.

*Char.* Possessing no spicules.

*Halisarca Dujardini*, Johnston. Great Britain.

— *lobularis*, Schmidt. Adriatic.

— *guttula*, Sdt. Adriatic.

- Halisarca mimosa*, Giard. English Channel.  
 — *cruenta*, Carter. Atlantic Ocean, Cape St. Vincent.  
*Gummina gliricauda*, Sdt. Adriatic.  
 — *ecaudata*, Sdt. Adriatic.  
*Chondrosia reniformis*, Nardo *ap.* Sdt. Adriatic.  
 — *plebeja*, Sdt. Algiers.  
 — *tuberculata*, Sdt. Adriatic.

## Family 2. Gumminida.

Char. Possessing spicules.

- Chondrilla nucula*, Sdt. Adriatic.  
 — *embolopora*, Sdt. Antilles.  
 — *australiensis*, Carter. Port Jackson, Australia.  
 — *sacciformis*, Carter. Mauritius.  
*Corticium candelabrum*, Sdt. Adriatic.  
 — *plicatum*, Sdt. Algiers.  
 — *stelligerum*, Sdt. Algiers.  
 — *abyssi*, Carter. Entrance to English Channel.  
 — *Kittonii*, Carter, prov. Colon, Panama.  
 — *versatile*, Sdt. St. Vincent, West Indies.  
*Sarcomella medusa*, Sdt. Algiers.  
*Osculina polystomella*, Sdt. Algiers.  
*Grayella cyathophora*, Carter. Red Sea.  
*Columnitis squamata*, Sdt. Antilles.  
*Latrunculia corticata*, Carter. ? Red Sea.

## OBSERVATIONS.

In noticing the filamentous feltiform trama of *Chondrosia reniformis* I have stated that this structure demands "distinct consideration;" for the element of which it is composed is so generally developed among the Spongida that it may be said to form one of their constituent parts; hence it not only deserves a distinct notice, but also a distinct appellation, and therefore will be described under the following name:—

*Elastic Tissue.*

I first alluded to this woof or texture in 1873, in these words, viz. :—

"Thus, although in the Gummineæ there is no 'sponge-skeleton-fibre,' so to speak, the cuticula and a great part of the body is made up of fine intercrossing filaments, which are so soft that, on drying, they all sink their form into a common homogeneous mass like hard glue" (No. 17, p. 20).

This tissue, when examined in water microscopically, is found to consist of short, soft, flaccid, apparently fusiform, opaque or translucent, whitish-yellow filaments of variable length, being in *Chondrilla sacciformis* (from the Mauritius) about 1-150th inch long and about 1-6000th inch thick in the middle: at least this is what may be inferred from the parts which project from a fringed-out edge of a fragment of the sponge just mentioned, when torn to pieces with needles, in water, and placed under a microscopic power of 300-400 diameters; for it is not easy, as Schulze says, to isolate an *entire* filament. In the condition thus mentioned it may be observed to be translucent, and when unstranded to be made up of a number of almost immeasurable fibrils, like the finest hairs, which, although bound together in the pointed end of the filament that may project from the border of the fragment into the water, sinks down on drying upon the glass slide into an expanded lash of fibrils that become elementarily undistinguishable in the gum-like homogeneous consistence which they altogether then assume. How far the filaments may be interunited like the elastic tissue of the warm-blooded animals, *ex. gr.* the human subject, I am unable to say; but of course such an arrangement would enhance the elastic power of the tissue; and this interunion actually seems to be the case in a *dye'd* and dried microscopic piece of *Halisarca Dujardinii* which I have mounted in balsam. At the same time, although generally distributed among the Spongida, the filaments of which this tissue is composed may not always present the same arrangement; and, again, although often alluded to as being "semicartilaginous," it should be remembered that this refers to the consistence and not the structure, which is not that of cartilage. When exposed for some time to the dyeing influence of aniline (magenta-red ink) it only becomes faintly coloured, compared with the sponge-cells and other sarcodic particles with which it is intermixed; while after having been dried and mounted in balsam in this state, no more of it can then be seen than has been above mentioned. As it is most abundant in those species of Carnosa which are most elastic and resilient, *ex. gr.* *Chondrosia* and *Chondrilla*, so it is least where the species is more easily torn to pieces, as in *Halisarca Dujardinii*, and apparently does not occur at all in *H. lobularis*, wherein, as before stated, I have not been able to discover any trace of it. How it originates I am unable to say; but it seems to me not impossible that its filament may have been an elongated fusiform cell whose contents generally have become developed into a bundle of fibrils such as that above described; nor am I able to say if it has any contractile power indepen-

dently of its elasticity; while of its composition Schulze states:—"Die Prüfung auf *Cellulose* mit Kupferoxydammoniak sowie mit Schwefelsäure und Jod ergab ein *negatives* Resultat" (No. 27, p. 19, Sep.-Abd.).

It is not confined to the Carnosa, although most abundant there; for it may be found more or less present in most sponges with and without the genuine dendriform fibre-skeleton; although, where the latter is absent, this elastic tissue seems to supply its place. Perhaps the effect of its entire absence is best seen in the *Calcispongiæ*, where, in consequence of this absence, the fragility after drying is so great that the more tender forms, *ex. gr. Clathrina*, will hardly bear handling without breakage.

How far, then, the presence or absence of the Elastic Tissue should influence our classification is the next point to be determined.

It may be remembered that my diagnosis of the order Carnosa is simply "without evident skeleton;" but to what extent this will suffice may be inferred from the facts that *Chondrosia reniformis* and *Halichondria suberea*, Johnston (No. 2, pp. 140, 197), = *Suberites domuncula*, Sdt., both come under this definition; for neither have an evident skeleton (that is, genuine dendriform anastomosing fibre), while *Chondrosia reniformis* presents the consistence of india-rubber, and *Halichondria suberea* that of crumb of bread. Hence the former has been placed in the order Carnosa, and the latter in that of the Holorhaphidota.

Now, as it is plain that *Chondrosia reniformis* possesses an abundance of the "elastic tissue," and *Halichondria suberea* scarcely any (if any), while both are equally "without evident skeleton," which is our present definition of the order Carnosa, it is evident that this definition alone is not sufficient.

Again, when the "elastic tissue" is ever so scantily developed in the dermal layer, the latter, however thin, as in *Grayella cyathophora* (No. 11), presents a gelatinous consistence, with slimy, slippery surface, rendered opaque by spirit of wine—which, while preeminently characteristic of the Carnosa, is, on the contrary, very different from the thin delicate transparent sarcodic film which characterizes the other orders. Hence it becomes necessary to add these points to our present definition of the Carnosa, which would then stand thus:—"Surface slimy, glutinous, without evident skeleton, more or less composed of elastic tissue."

Still there remains a little difficulty, as with all border-questions, in adjustment; for in *Donatia (Tethya) lyncurium*, after which I have proposed a group, viz. Donatina, in the

family Suberitida of the order Holorhaphidota (No. 23, pp. 182 and 184), there is a thick cortex composed of elastic tissue (charged, of course, with the spicules of the species), so densely developed that in consistence it is almost semi-cartilaginous, with no "evident skeleton;" while the same sponge, as before stated, grows *here* over shells in the form of an incrustation in which hardly more than the cortical layer is developed, thus simulating Schmidt's *Columnitis squamata* so closely that I cannot help thinking that one and all must be the same, and that therefore, if *Columnitis squamata* is, according to Schmidt, to be placed among his Gummineæ, *Donatia lynceurium* also ought to come under our Gumminida. That *Donatia* (originally called "*Tethya*" by Lamarck) has no specific alliance whatever with *Tethya cranium*, Johnston, which is the type of my group "Tethyina," may be easily seen by an examination of both species. Hence there seems no reason whatever why *Donatia* should not join *Columnitis squamata* among the Gumminida; so it may fairly be inserted in my tabulated enumeration of the Carnosa, p. 252, *anteà*.

It would have been satisfactory to have had a description of the form of the skeleton-spicule of *Columnitis squamata* in the text as well as in the illustration, in which the anteterminal inflation makes it differ from that of *Donatia lynceurium*; but in the Polymastina, which, not only in the tender but in the compact and hard forms, are in spiculation closely allied to *Donatia* (No. 25, p. 392), the head of the spicule constantly varies, even in the same species, between a simple fusiform acute and an anteterminally-inflated shaft.

Lastly, in *Axos spinipoculum* (No. 28, p. 286, pl. xxv. figs. 1-9) there is an unusual development of the elastic tissue in the cortex as well as about the excretory canal-system (*l. c.* figs. 6-8); so that, but for the presence of an "evident skeleton," dendriform and spiculo-fibrous, it also, would be placed among the Carnosa instead of the Holorhaphidota, where, perhaps, after all it should form a distinct genus in the group Axona (No. 32, p. 381). I mention this instance chiefly to show that the elastic tissue may be developed to a great extent in sponges which, possessing in addition an "evident skeleton," cannot therefore be admitted into the order Carnosa.

The soft, slippery, velvet-like dermis of the common black sponge of this coast, named *Dercitus niger* by Dr. Gray, and described by myself (No. 14, p. 3, pl. iv. figs. 1 &c.), = *Hymeniacidon Bucklandi*, Bk., of 1866 (No. 6), = *Battersbya Bucklandi*, Bk., of 1874 (No. 21), = *Pachastrella*, Sdt., of 1868 (No. 9), aptly compared by Dr. Bowerbank to "bullock's liver" when fresh, in which the elastic tissue is powerfully



developed, especially towards the surface, with no dendriform fibre-skeleton, but with an abundance of spicules, might also claim a place among the Carnosa—although I cannot speak with such certainty of the other species of *Pachastrella* that have come before me, which, as Schmidt has stated, are very ill-supplied in this way (“sehr arm an Weichtheilen,” No. 31, p. 69), while the habit of *Dercitus niger* of extending itself into the cracks and crevices, however minute, of the rock on which it may be growing, inclines me to the view that it would do this with other objects, such as shells and corals, under similar circumstances, if growing upon them: hence, on one occasion, I found its spicules, together with those of *Cliona mucronata*, Sollas, in the excavated multilocular cavities of a branch of stony coral from the island of Cuba.

And this opens another question, viz. how many of the Eccælonida (No. 29, p. 496) or excavating sponges may belong to the Carnosa; for, on the one hand, the tetractinellid spiculation of *Samus* is in form very evidently allied to that of *Pachastrella*, ex. gr. *Dercitus niger* &c., and on the other to that of *Corticium plicatum*, Sdt., *C. abyssi*, Carter, and *C. versatile*.

So far as *Cliona alata*, when growing within its excavated multilocular cavities in shells or rocks (calcareous), and when free in the form of *Rhaphyrus Griffithsii*, Bk., and *Cliona corallinoides* ('Annals,' 1871, vol. viii. p. 14, pl. ii. figs. 33-36) go, there is nothing but the absence of an “evident skeleton,” as in *Halichondria suberea*, that would induce me to place them among the Carnosa; and of the rest I can state nothing in this respect; but as regards the genera *Samus* (No. 30, p. 59), *Alectona* (olim *Gummina*) *Wallichii* and *Millari* (No. 29, p. 494), if not of *Thoosa socialis*, *Dotona pulchella*, and *Alectona Higgini* (No. 30, pp. 56-58), whose almost microscopic dimensions render this evidence respecting them presumptive only, the gum-like consistence of the sarcode, together with the presence of the elastic-tissue filaments and the absence of a fibre-skeleton, seems to claim for them all a place among the Gumminida; indeed Schmidt's *Corticium versatile* appears to be my *Samus simplex* (No. 30, p. 60, pl. v. figs. 26 a-c).

All these are “border-questions,” as I have said before, in which the transition of one kind of structure into another, as exemplified in different species of sponges, becomes perplexing to the classifier, who, after all, can only divide them at the confines of his grouping by an empiric distinction, chiefly based upon “degree,” which arrangements, under the best of circumstances, must be conventional, as there is no line of

demarcation in nature. But until all such facts as I have mentioned are known and duly considered, the classification of the Spongida will not become satisfactorily useful, although much may and must be done in this way previous to arriving even at this point; while at last, the nearest approach to the imaginary line of demarcation can only be attained by the most masterly mind on the subject.

#### CELLULOPHANA, Sdt., 1862.

Before concluding, it is desirable to turn our attention for a few moments to the nature of *Cellulophana pileata*, first named, described, and figured by Schmidt, who placed it among his Gummineæ or Kautschukschwämme (caoutchouc sponges), equal to our Carnosa (No. 4, p. 41, Taf. iii. figs. 24 and 24 a), but was so uncertain about its sponge-nature, that he proposed to refer the question to the botanists. He recurs to the subject again in his 2nd Supplement (No. 7, p. 22), but with little advancement, and finally ends with the description of another species from the coast of Florida, which is named *C. collectrix*, but, after all, adds in a "footnote" that the subject requires further observation (No. 13, p. 25).

His illustration of *Cellulophana pileata* (*l. c.*) represents a vertical section of the entire body, which had a roundish form, elongated and enlarged upwards, about  $\frac{3}{4}$  inch high and  $\frac{5}{16}$  inch thick, said to be "etwas vergrössert," whatever that may amount to, and to have been surrounded by a cortex enclosing a parenchyma, the former brown and thick, according to the illustration, and the latter carmine, passing into grey inwards. In fig. 24 a the epidermis is shown to consist of a thin fibrous layer with polygonal plant-like cell-structure underneath; while the second species, viz. *C. collectrix*, contained foreign bodies.

Now the chief objections to the sponge-nature of this organism are that no pores or oscula have been discovered in the epidermis, nor is there any excretory canal-system, while the presence of the polygonal cell-structure to which I have alluded (*l. c.* fig. 24 a) is also totally opposed, so far as my experience goes, to ordinary sponge-character, where all the cell-structure, if not polymorphic, is too gelatinous to present a defined cell-wall like that of plants. But I must refer the reader to the whole of Schmidt's observations, as they tend towards establishing the sponge-nature of this organism; meanwhile I would mention that I myself labour under similar difficulties with the organism from the Gulf of Manaar that I have provisionally named *Halsarca rubitogens*

#### ERRATUM.

By an unfortunate oversight on my part, which I regret extremely, Baron Maltzan's name has been misspelled in the earlier parts of this paper. Instead of "Maltzam" read "Maltzan," and instead of "*Heterocrypta Maltzami*" read "*Heterocrypta Maltzani*."—E. J. M.